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The Nutritive Value of NyPa Forage After Irrigation with Aquaculture Effluent

NyPa Forage as a nutrient filter for aquaculture effluent

NyPa Forage is a cultivar of perennial saltgrass (*Distichlis spicata*), which has been developed in the United States as a grazing plant for livestock. We have shown that, at least in laboratory experiments, NyPa Forage can be used to remove nitrogen and phosphorous from aquaculture effluent. We have now tested the effect of irrigation with aquaculture effluent on the growth rate and nutritive value of NyPa Forage.

The effect of effluent on growth rate and nutritive value

NyPa Forage plants were established in small wetland cells, with aquaculture effluent applied at one end of the cell and allowed to drain through to the other end. In a series of experiments, we varied the concentrations of nitrogen and phosphorous in the effluent (from 0 mg/L nitrogen and 0 mg/L phosphorous to 10 mg/L nitrogen and 2 mg/L phosphorous) and also varied the frequency with which the plants were cropped, to simulate grazing (from no cropping to cropping every 21, 42 or 63 days). The salinity of the effluent was maintained constant at 15 ppt (15.000 mg/L). Cropped plant material was collected, weighed and analysed in the laboratory for protein content, salt content, digestibility and metabolisable energy.

Yield increased linearly with the amount of nitrogen and phosphorous applied, but was not affected by cropping. Crude protein level, digestibility and metabolisable energy were all greater when at least some nutrients were applied, but did not differ very much among nutrient levels. Crude protein level, digestibility and metabolisable energy also differed among cropping treatments, being greatest when plants were cropped every 42 days. The table below compares yield and nutritive value of NyPa Forage between the best treatment (10 mg/L nitrogen, 2 mg/L phosphorous, cropping every 42 days) and the worst treatment (no nitrogen or phosphorous, no cropping).

Treatment	Yield (kg dry matter/ha/day)	Crude protein (%)	Dry matter digestibility (%)	Metabolisable energy (mJ/kg)
Best	1.5	16.7	67.6	9.5
Worst	31.4	5.4	51.6	6.8

How does NyPa Forage compare?

These results suggest that NyPa Forage may have a role as a salt-tolerant green feed over the summer/autumn period in southern Australia. As a rather general rule of thumb, liveweight maintenance of a 50 kg wether requires feed with a protein content of 8% and an energy value of more than 7.4 mJ/kg (equivalent to a dry matter digestibility of 55%). Most salt-tolerant annual and perennial grasses have less than these protein and energy requirements, while halophytic shrubs, such as saltbush, usually have sufficient crude protein, but are deficient in energy. NyPa Forage, when fertilised with aquaculture effluent and cropped regularly, exceeded these minimum protein and energy requirements.

Importantly, the salt concentration of NyPa Forage in all treatments was about 8 mg/g, towards the high end of the range found in most pasture plants, but well below levels often found in other halophytes (≥80 mg/g) and known to depress intake and liveweight gain in grazing livestock. This relatively low salt concentration reflects the fact that, unlike many other halophytes that tolerate saline conditions by accumulating salts in their tissues, NyPa Forage actively excretes salt through salt glands.

The yield of NyPa Forage was dramatically improved by fertilisation, as you would expect. It is unlikely that the same yield could be achieved on farm as in the laboratory trials, however even if 70% of the maximum yield could be obtained, then we could expect a total yield over late summer/autumn of 2.9 t dry matter/ha. This is less than half the yield that could be obtained from well managed improved pasture in southern Australia, but compares favorably with the yield from other salt-tolerant pasture plants.

Livestock feeding trials are needed

We need to bear in mind that the results reported here are all based on laboratory analyses. We do not know whether the same values can be obtained for yield and nutritive value when the plant is grown on farm. Even more importantly, we have not yet tested the palatability and performance of the plant in livestock feeding trials. This is the next step that needs to be undertaken before we can say with confidence that NyPa Forage can act as both a nutrient trap and a valuable livestock feed on salt-affected farmland.

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